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THE COLOSTRUM COUNSEL

How can heat stress during late-gestation affect our calves and colostrum quality?

There's no better time than summertime, but the stress from the heat can take it's tole on pregnant cows, and their calves. The effects last long into the pre-weaning period, so care needs to be taken to avoid heat stress in the animals that are the future generation of the herd.

During the summer months, it is hot and humid and we notice that our lactating cows reduce their feed intake and in turn they do not produce as much milk as they did during the cooler season. Similarly, when cows are exposed to heat stress during late gestation, we see compromised mammary gland development before calving, followed by decreased milk production after calving. While the physiology of what is happening to our cows during heat stress is well understood, there is much less concrete evidence about how this can affect the unborn calf and colostrum quality.

The results of heat stress during the pre-partum period on calf growth are well-agreed upon among researchers and similar results are seen across studies when we have calves born to cows that are either exposed to a heat-stress environment or a cooled environment. For starters, **calves born to heat-stressed cows weigh less at birth compared to calves born to cooled cows**. Research conducted in the 1970s has shown that this occurs due to decreased blood flow to the uterus, as well as decreased placental weight, which results in fewer nutrients reaching the fetus and thus a lighter calf at birth. Moreover, heat-stress often decreases the length of gestation, which can also affect calf birth weight. These weight differences may carry over into the pre-weaning and weaning period. For instance, a study conducted in 2017 demonstrated that **cooled calves gained 0.2 kg more per day and weighed 4 kg more at weaning compared to heat-stressed calves**.

In addition to affecting growth, **calves born to heat-stressed cows are also less efficient at absorbing IgG compared to their cooled counterparts.** Multiple studies over the last decade have demonstrated that compared to cooled calves, heat-stressed calves have lower blood IgG concentrations and lower apparent efficiency of absorption (AEA) of IgG. The apparent efficiency of absorption of IgG basically tells us how much IgG the calf is absorbing from the colostrum

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on a percentage basis. For example, a study conducted at the University of Florida reported that heat-stressed calves were only able to absorb 12% of the available IgG from colostrum, while cooled calves were able to absorb 20%. In this study, as well as many others, calves are fed colostrum from their own heat-stressed dams.

This led researchers to form two questions:

1. Are the differences in IgG absorption due to heat-stressed calves being fed poor quality colostrum from heat-stressed cows?

2. Are heat-stressed calves less efficient at absorbing IgG because of an effect of the heat-stress during gestation on the calf itself?

Regarding the first theory, reports on whether or not heat-stressed cows have decreased colostrum quality are conflicting. Many studies have found that **heat-stressed cows have lower colostrum quality (amount of IgG/L) and quantity (total amount of colostrum produced) compared to cooled cows.** In support of this research, testing of more than 100,000 colostrum samples per year over the last 20 years from our lab (SCCL, Saskatoon, Canada) has demonstrated that IgG in colostrum can decline by up to 20% in the summer compared to other seasons. Yet, some studies are still reporting that there is no difference between the colostrum of heat-stressed and cooled cows. Many of these studies often pool colostrum from heat-stressed cows, test colostrum from only a small group of animals, or do not record the colostrum yield; all of which may affect the concentrations reported. However, as there are many factors that can influence colostrum quality aside from calving season, it is always a good idea to test the quality of your colostrum before feeding it to your calves to ensure passive immunity regardless of the time of year.

While the research on colostrum quality in heat-stressed cows is conflicting, a study in 2014 sought out to determine whether the decreased passive immunity in heat-stressed calves was due to a colostrum effect or due to the second theory mentioned above: a calf effect. This study demonstrated that even when both groups of calves are fed the same colostrum from cows kept in a thermoneutral environment, heat-stressed calves still have a lower blood concentration of IgG at 1 day of life compared to cooled calves. Moreover, when calves born to thermoneutral dams were fed colostrum either from heat-stressed or cooled cows, no differences in blood IgG concentrations were observed. This shows us that **regardless of the colostrum source, heat stress during the last weeks of pregnancy somehow negatively affects the calf's ability to absorb IgG when it is born.**

So, why are heat-stressed calves less efficient at absorbing IgG? As mentioned previously, calves born to heat-stressed cows are lighter at birth, which may lead to a lower small intestinal surface area to absorb IgG. Basically, no matter how much IgG is fed, smaller calves do not have as much surface area on their small intestine to absorb it into the blood. Researchers have also hypothesized that heat stress during late pregnancy may impair the development of the small intestine; either resulting in less surface area for the absorption of IgG or a decreased number of intestinal cells available to absorb the IgG.

In summary, calves born to heat-stressed cows have a lower birth weight, reduced growth during the pre-weaning period, and a decreased ability to absorb IgG from colostrum compared to calves born to cooled cows. Although research regarding the quality of colostrum from heat-stressed cows varies, it is important that we feed calves born during the summer season the best quality colostrum possible in order to increase their chances at being as healthy and productive as their cold season counterparts.

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